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REPORT ON OTOTOLOGY.

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ANATOMY AND PHYSIOLOGY.

RUEDINGER.—Beiträge zur Histologie des Mittleren Ohres. München. 1873.

BURNETT.—Bloodvessels of the Membrana Tympani. Amer. Jour. Med. Sciences. Jan., 1873.

ZUCKERKANDL.—Ueber die Arteria Stapedia des Menschen. Monatschrift für Ohrenheilkunde. Jan., 1873.

WEBER, F. E.—Der Musculus Tensor Tympani. Idem. Oct., 1872.

MACK.—Zur Theorie des Gehörorgans. Prag. 1872.

LUCÆ.—Zur Diagnostischen Verwerthung der Schalleitung durch die Kopfknochen. Berliner Klin. Wochenschrift. 1871.

LUCÆ.—Maximal Phonometer. Idem. 1872.

BERTHOLD.—Taube Puncte des Ohres. Idem. 1872.

The histology of the middle ear has been made the subject of minute study by Rüdinger for a long time, and the observations of so accomplished an anatomist are worthy of more extended notice than is here possible. But a few of his observations, more especially on some of the points of controversy which have arisen of late years, can be mentioned in this paper.

The surface of the ossicula consists of general lamellæ, which enclose bone-corpuscles throughout, and, in their deeper layers, also, groups of so-called giant cells. The canals of Havers resemble those in the short bones of the extremities and unite in a large central cavity, the medullary cavity. Specimens of osteoporosis and of osteosclerosis were also found. The cartilaginous layer over the hammer, which was first described by Gruber as a distinct tissue, and one which played an important rôle in the movements of that bone, but which has been considered by Prussak and others as merely belonging to the periosteum, Rüdinger allows to be distinct from the hammer, but describes it somewhat differently from Gruber. At the lower end of the manubrium, the layers covering the hammer are a fibrous tissue containing cartilage cells, which he calls fibrous cartilage; within this, and closely surrounding the whole hammer, is a layer of pure hyaline cartilage, the boundary between the two forms of cartilage being very distinct. This hyaline cartilage, Rüdinger acknowledges, may be the remains of the foetal cartilaginous hammer, but, as Gruber says, it persists through life. The resemblance of these cartilaginous layers on the hammer to the cartilages seen in the joints of the ossicula, lead Rüdinger to think that they are special histological media for the transmission of sound-waves. The cartilaginous layers are still found the same, but varying a little in thickness as we pass up the hammer, but that bone itself is more and more isolated from the membrana tympani. As we approach the short process, the layer of hyaline cartilage becomes gradually thicker on the external edge of the hammer, and thinner on the other surfaces, till, at the point of the short process, it has entirely disappeared, except externally, where it forms a thick



bolster closely attached to the bone. The space between this cartilaginous bolster and the short process, which Gruber describes, could not be found by Rüdinger, but on each side of the cartilage is an angle, filled in with connective tissue, in which spaces exist, the walls of which are of variable thickness. These spaces he considers to be vessels and not a discontinuity between the cartilage and the membrana tympani.

The pouches of the membrana tympani, described by Troeltsch as duplicatures of the membrana propria, but by Gruber and Henle as simply folds of the mucous membrane, Rüdinger says contain a strong layer of parallel fibres, resembling the radial fibres of the membrane, and serve as ligaments to hold the hammer, on which account he has named them the pouch-ligaments of the membrana tympani. The other ligaments he has described nearly as given by other authors.

The ring in which the membrana tympani is inserted, called by older writers the annulus cartilagineus, contains, in the human being, no cartilage, but is composed of fibrous tissue, a continuation of the periosteum, and, therefore, named by Rüdinger the annulus fibrosus.

After careful study of the articulations of the ossicula, Rüdinger reasserts what he has already published (*Virchow's Archiv*, 1860). Both in the articulation between the malleus and incus, the incus and processus lenticularis and the processus lenticularis and stapes, a freely movable meniscus of cartilage is found, thus making a joint of two chambers as is found at the clavicle. The tendon of the stapedius muscle is attached not only to the stapes but also to the capsule of the joint and the processus lenticularis.

By means of preparations colored with chloride of gold, Burnett has studied the arrangement of the bloodvessels and nerves of the membrana tympani in different animals, and finds that they vary somewhat from the arrangement found in the human membrane. In the dog, cat, goat and rabbit, small vessels pass from the periphery towards the manubrium, and, also, from the manubrium towards the periphery, at nearly equal distances from each other; and then turn abruptly towards their starting point, thus forming a series of vascular loops. In the Guinea-pig, however, the vessels form a net-work of coarse quadrangular or pentagonal meshes, an arrangement similar to that in man, except that the meshes are coarser and the vessels finer. These arrangements of the vessels Burnett has found constant and peculiar to these animals.

The arteria stapedialis, generally described as abnormal, Zuckerl and affirms to be constant, taking its origin from the arteria stylo-mastoidea which enters the tympanum above the foramen ovale. It gives off a branch to each arm of the stapes and one to the base of that bone, and anastomoses with a branch of the arteria nervi. tympani comitans, or else with the arterial plexus of the promontory.

The tensor tympani muscle is surrounded throughout its entire course by a fibrous sheath, arising from the roof of the tubal cartilage and from the edge of the fibro-cartilago basilaris and passing along the entire muscle. The tympanic sheath of the muscle which has been considered to be mucous membrane, Weber has found to be fibrous tissue, a continuation of the sheath covering the muscle within the osseous canal. The muscle itself takes its origin only from the posterior cartilage of the Eustachian tube and three bundles of fibres, an outer, middle and inner, arise from this tissue to form the muscle. The

length of the tendon of the muscle, from the rostrum cochleare to its insertion on the hammer, Weber gives at two and one-fourth millimetres, and its direction somewhat forwards and downwards. Its insertion on the hammer is three and three-fourths millimetres above the end of the manubrium, and four and one-half millimetres below the top of the hammer.

Mach agrees with Helmholtz that the conduction of sound to the labyrinth-water takes place by vibrations of the ossicula as solid bodies, and not by vibration of the separate molecules composing them; and also with the theory of Seebach in regard to the manner in which the tympanic apparatus is enabled to conduct oscillations of various durations equally well. He then considers the question of how the arrangement of the tympanic apparatus in separate masses, each of which possesses special elastic power, must act, and by calculation concludes that this arrangement must increase or diminish the tones according to the condition of these masses. The tympanic apparatus, then, does not conduct all tones equally well, but rather always favors some particular part of the scale of notes, the part favored, however, depending on the tension of the tensor tympani muscle. In addition to the accommodative function of the tensor tympani muscle in varying the tension of the membrana tympani, Mach would thus assign to this muscle the ability to change the conducting power of the whole tympanic apparatus.

In explanation of the established fact that, when a vibrating tuning-fork is placed against the bones of the skull and one ear is tightly closed, the fundamental tone of the fork will be heard louder in the closed than in the open ear, Mach had advanced the theory that a certain amount of the sound which generally passed out of the meatus and was lost to our perception was, by the closure of the meatus, reflected back on to the labyrinth, and thus produced a greater impression on the closed than on the open ear. This idea was based on the theory of Duhamel that the force of a sound is always measured by the difference between the influx and efflux, and must vary whenever the influx or efflux is disturbed. Lucæ, however, considers himself justified, from experiments, in denying any such efflux of the sound, and affirms, moreover, that the reinforcement of the tone is entirely dependent on the length of the column of air in the closed ear, i.e. on the proportion existing between the length of the air-column and the length of the waves of the tone employed. If the tone  $c'$  is used and the length of the meatus is increased by the insertion of a rubber tube eleven inches long, thus making the column of air one-fourth the length of the sound-wave, the fundamental tone is deadened and its octave is heard distinctly; if the column of air is increased to twenty-four inches, the fundamental tone is again reinforced, since the course of the reflected waves is equal to the whole length of a wave of the tone  $c'$ .

Other observations of Lucæ on the influence which the direction of the vibrations in the bones of the skull exert on the amplitude of the vibrations of the membrana tympani show that the vibrations of the membrane are greatest when the waves of sound strike perpendicularly to the plane of the membrane. This fact can be demonstrated by closing both ear-passages and placing a deep tuning-fork on the centre of the head; the tone will then be perceived equally strong in each ear. If the fork is now moved to one side, to a point perpendicular to

the plane of the opposite membrane of the drum, the tone will be heard strongly and almost entirely in that ear.

Lucæ has constructed an instrument for the purpose of measuring exactly the pressure of the breath exerted in speaking, i.e. the intensity of the speech. It consists of a paste-board cylinder, 190 millimetres long and 48 millimetres in diameter, one end of which is funnel-shaped, and covered at the edge with a roller of rubber so that it can be applied tightly over the mouth. The other end is closed by a membrane of rubber, so stretched that the slightest compression of the air in the tube will move it. On the edge of the tube a light metallic lever is attached, the lower end resting on the centre of the rubber membrane, and the upper end moving over a quadrant marked in degrees and attached to the body of the instrument. Any word then spoken into the tube presses the rubber membrane, and with it the lower end of the lever, outwards, while the upper end of the lever is pressed in the opposite direction over the quadrant on which the extent of its motion can be measured. A very light spiral-spring presses the lever against the quadrant so that it remains at the point of maximum motion. The instrument has the practical value of determining empirically the intensity of one and the same spoken word, and, therefore, gives a more exact test of the hearing for language than was before possible.

In regard to the alphabet, it is found that the maximal intensity is greatest for the explosives B, G, D, P, K, T ( $18^{\circ}$ - $38^{\circ}$ ); least for the letters S, W, C, Z, I, L, F, V and R ( $2^{\circ}$ - $12^{\circ}$ ), while the vowels have a value of  $9^{\circ}$ - $15^{\circ}$ , and Sch, X and H a value of  $14^{\circ}$ - $19^{\circ}$ .

These values are not, however, proportional to the ease with which the letter is perceived by the ear, with the exception of the letters P, T, B, I, for the instrument can merely measure the pressure of the air used in forming a letter, while certain letters, especially the vowels, and the consonants F, Sch, Ch and S before a vowel, are increased in intensity by the resonance of the cavity of the mouth without a great pressure of air, consequently their intensity is greater for the ear than for the phonometer.

#### PATHOLOGY AND THERAPEUTICS.

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FUERSTNER.—Othæmatoma. Archiv für Psychiatric, iii.

BUCK.—Unusual Cases. New York Medical Record, Dec., 1872.

WENDT.—Ueber das Verhalten des Gehörorgans bei Variola. Archiv der Heilkunde, 1872.

POLITZER.—Ueber Traumatische Trommelfellrupturen mit besonderer Rücksicht auf die forensische Praxis. Wiener Med. Wochenschr. 1872.

BLAKE.—Perception of high musical Notes. Transactions of Amer. Otological Society. 1872.

GRUBER.—Zur Entfernung fremder Körper. Allg. Wiener Med. Zeitung. 1872.

JACOBY.—Bchandlungresultate bei complizirten Otorrhœen. Archiv f. Ohrenheilk., vol. vi.

SCHULTZE.—Ein Beitrag zur Technik des Nasen-douche. Idem.

LUCÆ.—Ueber locale Anwendung des Chloral Hydrats. Berliner Klin. Wochenschr. 1872.

WEBER.—Krankheiten der Muskeln. Berliner Klin. Wochenschr., No. 32, 1872.

BÖTTCHER.—Veränderungen der Netzhaut und des Labyrinthes bei Fibro-sarcoma des Nerv. Acust. Archiv f. Oph. and Otol.

BÖKE.—Caries des Felsenbeines. Archiv f. Ohrenheilk., 1872.

VOLKMAN.—Caries des Processus Mastoideus. Habilitations-schrift von Dr. Schele. Halle. 1872.

Lucæ re-asserts that the so-called corpora amyacea of the membranous semi-circular canals are a pathological formation peculiar to the adult human being. He has never found them in the new-born child, but considers them to be produced either by local disturbances or general disease. He has found them in gray degeneration of the spinal cord, typhus and typhoid fever, tumor of the brain, tuberculosis, Bright's disease, chronic ulcer of the stomach, and also in cases where there was a disease of the ear at time of death, as, for instance, otitis media.

Rüdinger, on the contrary, asserts that he has always been able to find them, at least partially developed, in man, and that, therefore, they are natural structures; their reaction with iodine is the same, he says, as that shown by the tunica propria and other tissues in which no starch exists. He considers them papillary prominences on the inner surface of the tunica propria of the membranous canal, their function possibly being to supply a large secreting surface.

In order to determine the cause of othaematoma, Fürstner has examined the auricles taken from one hundred and thirty individuals of all ages, without reference to the cause of death, and arrived at the following conclusions. In opposition to the conclusions of other investigators, he asserts that the cartilage itself contains no vessels, but that conical projections of perichondrium, with their vessels, run into its substance. Often in early life, and always in old age, the cartilage of the auricle undergoes the same changes which have been observed in other cartilages, namely, a softening consisting of three stages—the hyaline metamorphosis, the fibrillary and granular destruction, and, finally, the liquefaction of the cartilage, with the formation of cavities. The cavities so formed contain fluid, reacting like mucin, and frequently occupy the whole thickness of the cartilage, presenting the appearance of a line of fracture; the absence of pigment and haematoïdin crystals proves, however, that no fracture has taken place. Other changes in the cartilage of the auricle consist of new-formations; enchondroses, in which, by a retrograde metamorphosis, cavities are formed, or calcification or ossification may take place; and enchondromæ, which Fürstner found to be rare.

Othaematoma he regards as always of traumatic origin, favored, perhaps, by some of these chronic changes in the cartilage; the possibility of their spontaneous development from some peculiarity of the vessels, he absolutely denies. One preparation of an othaematoma showed distinctly the results of an injury, together with the preceding chronic process of degeneration. If, as has been so often asserted, this disease is much more frequent in the insane than in healthy persons, Fürstner would assign as the reason the greater liability of such persons to injury.

An unusual malformation of the hammer is described by Buck, the tip of the manubrium being bent forwards upon itself in the plane of the membrana tympani, so as to form a regular hook.

In an exhaustive article of 100 pages, Wendt gives the results of

his dissections of one hundred and sixty-eight ears taken from persons who died of variola, vera and haemorrhagica. The investigations were undertaken with the view of determining (1) the results of the disease on the ear, and in how far the ear-disease was the cause of other diseases; (2) the existence of the more minute tissue changes; (3) the anatomical cause of the functional disturbances observed during life; (4) to compare the appearances during life with the results of the dissection.

Heretofore, the difficulty of removing all the parts without disfiguring the body has been a serious obstacle, but Wendt proposes a new and simple method. After opening the head, a broad chisel is driven perpendicularly downwards, a short distance in front of the anterior edge of the body of the sphenoid (one and a half centimetres in front of a line drawn from the outer ends of the lesser wings). In this opening a narrow saw is inserted, and worked perpendicularly in a convex line through the lesser and greater sphenoid wings, the horizontal part of the temporal bone close to the vertical portion, then obliquely through the posterior part of the mastoid, and, finally, through the posterior end of the crista ossis petrosi. The remaining parts, to the anterior edge of the foramen magnum, are then broken through with a chisel, and the whole separated by the knife. The whole ear, with the entire Eustachian tube, is thus removed and the naso-pharyngeal cavity exposed.

The pathological changes found were some of them identical with the variolous disease, or closely related to it, while others were such as are found with other general or local diseases. Pustules were seen frequently on the auricle, occasionally in the cartilaginous, but never in the osseous meatus, while hyperæmia and swelling of the corium, serous infiltration of the epithelium, with swelling of the reté Malpighii, were not infrequent in the osseous portion of the passage. The same changes were found in the orifice and lower portion of the Eustachian tube which were seen in the nasal cavity, hyperæmia, haemorrhage, diffuse swelling, with deposition of pus corpuscles, either between the epithelial cells or in distinct collections and ulcerations, only extending, however, through the epithelium. Purulent infiltration, with some thickening of the epithelium, was occasionally found in the middle ear.

The other changes, which are not of a specific character, but such as are found in many diseases, were, hyperæmia, diffuse and circumscribed haemorrhage, swelling and abnormal secretion of the mucous membrane lining the middle ear. In the few cases in which the labyrinth was examined, marked hyperæmia was found in those cases where there was a general hyperæmia of the brain.

From the cases examined, both before and after death, Wendt concludes that hyperæmia of the mucous membrane of the middle ear has little or no influence on the hearing. The interference with the hearing-power from secretion in the tympanic cavity is variable, but not extreme, depending on the consistence of the fluid; the swelling of the mucous membrane, however, from diminishing the normal mobility of the conducting apparatus, and from causing abnormal connections between its parts, may interfere very seriously with the functions of the ear, and the retrogressive metamorphoses of this swelling may result in a permanent diminution of the vibratory power of these parts.

The variolous processes proper, Wendt considers, heal without injurious effect on the ear, as he has never found stricture, contraction or obliteration in the tube as the result of that process. The other pathological processes, however, which are not characteristic of variola, may produce the same changes as result from catarrhal inflammations in many general diseases, and one of the most interesting results of his observations is the minute and accurate description of the condition of each part of the ear in these catarrhal inflammations.

POLITZER gives the results of his experience in accidental ruptures of the membrana tympani, more especially in those caused by a blow on the ear, calling attention to the importance of these cases in medico-legal medicine and the little that is said on the subject in forensic works. The early examination of the membrane is of the greatest importance, as the appearance of the opening is so characteristic that it can be determined from that alone whether the opening is the result of injury or of disease. Ruptures from injury have been generally described as a simple tearing of the membrane on the posterior segment, parallel with the manubrium, the edges lying in contact and only separating when air was forced through. Politzer, however, considers that such a condition is the exception, for in most of his cases there was a wide opening, owing to the retraction of the fibres. The position of the rupture was more frequent on the posterior and lower than on the anterior half of the membrane, and usually midway between the hammer and tendinous ring; its form, either round or oval. The remainder of the membrane, with the exception of a slight congestion along the hammer, is normal. The resulting deafness is variable; most marked when the labyrinth has also suffered from the concussion.

Where the membrane alone has suffered, the deafness is slight, the watch and voice are heard fairly, the tuning-fork on the head is heard only in the injured ear and subjective noises are wanting. It sometimes happens that the force of the blow is expended on the labyrinth without injuring the membrana tympani, and in these cases, which are much more unfavorable, there is a great degree of deafness, violent subjective noises, and the tuning-fork is heard in the uninjured ear. Occasionally, rupture of the membrane is combined with concussion of the labyrinth.

One characteristic of a rupture from injury, as distinguished from one from disease, is the perforation whistle when air is blown through. In a traumatic rupture, the air passes through with a broad, deep sound, but in a pathological perforation with a sharp whistling; the force necessary to produce the sound is also much less in the former than in the latter case. The course of the injury, where the labyrinth is unaffected, is generally favorable, the opening closing without marked inflammatory reaction, as Politzer says, generally by a growth from the inner layer of the membrane first. Some days after the injury, a greyish-yellow membrane is seen to be "pushed over" the rupture from the inside, and, after this membrane has entirely closed the opening, the torn edges of the cutis can still be seen for several weeks. A suppurative inflammation of the membrana tympani or middle ear is occasionally seen after a traumatic rupture, but is, according to Politzer, usually the result of an irritating treatment, such as instillations. The restoration in these cases is often perfect, but occasionally the inflammation becomes chronic, and a permanent opening, with greater or less deafness, remains.

In the majority of ruptured membranes, the functions of the ear are completely restored. Where changes have taken place in the middle ear as the result of suppuration, or where the labyrinth has suffered from severe concussion, deafness of variable degree may remain. In concussion of the labyrinth, the hearing may be restored, even after weeks, but more frequently some disturbances of the ear remain for life.

The treatment of these ruptures is simple: local applications and syringing are to be avoided; the exposed mucous membrane of the tympanum should be protected by excluding the air. In concussion of the labyrinth, Politzer claims to have improved the hearing by the constant electric current.

In a legal point of view, it is all important that an examination of the affected ear should take place within a few days of the injury, for after that time, as cicatrization may have taken place, it may be impossible to say whether rupture had existed or whether any existing deafness is due to the injury. A suppurative inflammation from an injury cannot be distinguished from a primary suppuration.

The degree of injury to the ear may be regarded as slight when the labyrinth has escaped concussion and when the rupture heals so that the hearing is perfectly restored; as severe when the labyrinth has suffered, and when, after cicatrization has taken place, repeated examinations during several months still show some disturbance of function. The injury may also be called severe when suppuration has supervened and permanent changes in the middle ear, such as adhesions, have resulted therefrom. An observation of, at least, three months, may, in some cases, be necessary before testimony could be given in regard to the permanency of pathological changes, as the ear may require that time to recover from a concussion of the labyrinth.

Concussion of the labyrinth without injury to the membrana tympani gives no objective appearances, and it is impossible, from the examination, to decide whether an injury is the cause of the existing disease in the ear.

The investigations of Blake are of interest, both from a physiological and pathological point of view. They were undertaken with a series of König's steel rods, and carefully carried out. From them it would seem that the perception of high musical notes depends on the conducting rather than the perceptive apparatus of the ear, and varies, diminishing with increasing age or with thickening of the mucous membrane of the tympanum, but increasing with increased tension of the membrana tympani. In perforations of the membrane, the perception for high notes increased, but varied somewhat according to the size and seat of the opening, and the tension of the conducting apparatus, being greatest where the perforation was on the posterior part of the membrane and of large size. A number of cases where it was necessary to make an artificial opening in the membranes were used for testing the truth of the observations, with the result of an improved perception for the notes, after the operation, the increase in one case being from 35,000 to 80,000 vibrations. In most cases of chronic catarrhal inflammation of the middle ear, the limit of perception was 35,000 vibrations, but it occasionally reached 40,000 and 50,000; in these latter cases, however, the membrana tympani was much drawn inwards and consequently very tense. Two cases of voluntary contraction of

the tensor tympani muscle showed clearly the improved perception from increased tension of the membrane, the hearing for high notes increasing in one case by 5000, in the other by 10,000 vibrations, during the contraction of the muscle.

Gruber was led, from the difficulty which he experienced in removing a bean from the ear, to experiment on the possibility of causing such swollen vegetable substances to shrivel up so that they could be more easily removed. After trying a large number of solutions, the only effectual ones for this purpose were found to be sulphate of zinc (0.2 to 30) and lime water (10 to 30). In the case in which a bean had been impacted and become so swollen that it could not be removed, he was, by means of an instillation of sulphate of zinc, enabled so to reduce its size that removal was very easy.

Jacoby publishes a series of fifteen cases of otorrhœa, treated by means of galvano-caustic, in addition to the four already published by him; all of them were complicated by polypoid granulations, or by polypi, and the results of the treatment were very favorable, although he fails to show that the same results could not have been obtained by other caustics.

For the purpose of more thoroughly cleansing the posterior nares than is possible by the common form of the nasal douche, Schultze uses a metallic tube, resembling an Eustachian catheter, closed at the end and with numerous perforations. This being attached to a common douche, it is possible, by turning the instrument, to shower any part of the cavity desired.

In cases of so-called chronic dry catarrh of the tympanum, in which no marked changes in the curvature of the membrana tympani were visible, Lucae has used, with good effect, injections of chloral hydrate (1.0 to 30.0). A few drops of the fluid were injected through the catheter every third or fourth day, and in those cases where the treatment was of avail an improvement was noticed after the second or third injection. The action of the medicine is that of an irritant, and the reaction from the injection may be quite severe, but is of short duration.

In eleven per cent. of his cases, there was a very marked improvement of the hearing, and in twenty-five per cent. a slight improvement. The results gained by the use of this solution he has found to be more permanent than those obtained by other means.

Weber considers that in many of the hitherto incurable forms of chronic catarrh of the middle ear, the primary trouble is a disease of the muscles of the Eustachian tube and middle ear. The cases are those of gradually progressive deafness, associated frequently, but not necessarily, with a catarrhal inflammation of the naso-pharyngeal mucous membrane; beginning on one side, most frequently on the left, with subjective noises, but without other symptoms, and going on to almost complete loss of hearing. He thinks that, as far as the membrana tympani and chain of ossicles are concerned, it depends chiefly on those muscles which bring the parts in contact with the labyrinth whether we hear well or not, and whether the labyrinth is pressed upon abnormally. It is also well known that the palatine and tubal muscles serve to ventilate the tympanum, and that the tensor tympani muscle is in close relation with the tensor veli palati. If, then, the tubal muscles are diseased, especially the tensor veli, he considers that the tympanic

muscle also suffers, and the whole mechanism of the acoustic apparatus is affected.

The disease of the muscles consists in a weakness or complete paralysis, or else in a spasmotic contraction, and may be caused either by general disease, such as chlorosis, anaemia, hysteria, or by local hyperæmia or inflammation set up from the inflammation of the mucous membrane.

The treatment which Weber claims to have used with marked effect, is, first, to remove the inflammation of the naso-pharyngeal mucous membrane, and then to treat the disease of the muscles by electricity. For this purpose he considers it necessary to apply both the constant and the induced current along the course of the muscles. This he does by inserting one electrode directly in the Eustachian tube by means of an elastic rubber catheter, and the other in the pharynx, uvula, side of the neck, or vertebral column. The electric current requires to be used with care, and not applied frequently or strong enough to produce much irritation. One of the first effects is a complete cessation of the noises for a short time, and then for longer and longer intervals. The earlier this treatment is used, the better and quicker is the result.

These views of Weber's on the pathology of this disease are based on a number of dissections published by him in the *Monatschr. f. Ohrenheilk.*, in which the only disease found was a fatty degeneration of the muscles of the tympanum.

In a case of fibro-sarcoma of the brain with consecutive blindness, deafness, perverted taste and other functional disturbances, Böttcher found that the tumor extended to the labyrinth through the porus acusticus internus. The acoustic and facial nerves retained their outward form, but the nerve-sheath was imperfect, being broken irregularly into scales. All the canals of the modiolus, through which the nerves normally pass, were filled with a nucleated connective tissue and a large number of bloodvessels, and around the vessels was much brown pigment enclosed in caudate cells. No signs of any nerve elements could be found in the whole modiolus, and the lamellæ of the lamina spiralis ossea were filled with a transparent nucleated connective tissue. The inner and outer hair-cells were atrophied, but the other portions of the cochlea remained intact. The nerve fibres of the vestibule could not be found, and there was a marked atrophy of the ganglion geniculi of the facial nerve.

At the Naturforscher-Versammlung, Böke showed a number of interesting and new preparations of caries of the petrous bone. In one, the tympanum and external meatus were converted into one large carious cavity, the roof of the tympanum was largely destroyed, the fossa sigmoidea and incisura mastoidea were perforated, and yet the external lamella of the mastoid process remained intact. The patient had had an otorrhœa for years, and finally died with the symptoms of tuberculosis of the lungs. A paralysis of the facial nerve appeared a few weeks before death. The autopsy revealed an abscess of the middle lobe of the brain on the same side as the ear disease. In a second preparation, the fossa sigmoidea was perforated; other parts were free from caries. The otorrhœa was of two years' duration; brain symptoms showed themselves six days before death, and the autopsy revealed an abscess of the brain, which communicated with the ven-

tricle on the same side as the ear disease. A third preparation showed cicatrices on the membrana tympani and the mastoid cells, filled up with a compact, newly-formed mass of bone, the result of a long-continued otitis media. Several cases were related of otitis media without caries, in which death occurred from abscess of the brain.

The result of Böke's observations is that in long-continued otorrhœa it is impossible to determine with what deep changes we have to deal; in many cases the external ear shows no disease, when the bone and even the brain may be already affected.

In caries of the petrous bone, the symptoms during life are by no means proportional to the anatomical changes found, and a precise method of treatment cannot be given. Böke has found that in most cases astringents and caustics increase the acute symptoms and do not diminish the otorrhœa. He advises merely the removal of the discharge by warm water injections; polypoid growths should be removed with the greatest care, as frequently carious bone lies behind them, which may cause serious trouble. Abscesses over the mastoid should be opened, and if the bone is found softened and carious it should be removed; he does not approve, however, of trephining the healthy bone.

In five cases in which the mastoid process was found to be either distinctly carious or much softened, Volkmann laid bare the bone, and the carious portions were scraped out with a sharp spoon. In from three to ten weeks, cure of the caries resulted in all the cases. In one case, it was necessary to repeat the operation once.

